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Abstract: By distinguishing between prior intentions and intentions in action, Searle has helped solve a number of difficulties confronted by the earlier versions of the causal theory of actions. Yet this distinction also raises important new issues. In particular, once a distinction is posited between two types of intentions, one must specify what the exact nature of their respective contents is and explain how the two types of intentions are connected. I suggest that in addressing those issues we could benefit from the insights provided by recent work in the cognitive neuroscience of action. I try to show how this work can help us give a more precise characterization of the content of intentions in action and bridge the gap between prior intentions and intentions in action.

1. Introduction

Beginning with Davidson's seminal paper 'Actions, Reasons and Causes' (1963), the Causal Theory of Action has been a popular approach to understanding both the nature of actions and the explanation of actions. Numerous versions of the Causal Theory have been offered and although I doubt any of them is at present perfectly satisfactory, I believe this general approach to be on the right track. According to Bach (1978, pp. 361–2), to be adequate a theory of action should do justice to the following facts: (1) that explanation of action is causal explanation (in particular, a reason does not explain an action unless it is also a cause of the action); (2) that behaviour counting as action is distinguished partly by how it is brought about and partly by how it is experienced by an agent; and (3) that some actions (routine, automatic, impulsive actions) are not deliberate or preceded by any conscious intention to perform them.[1]

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[1] Bach calls these actions 'minimal actions' and claims that they are not, under any description, intentional. Yet, it is important to note that his notion of an intentional action is pretty strong: according to him, an intentional action is an action caused by a, characteristically conscious, intention, where the having of such intentions involves conceptual abilities, including a capacity for self-ascribing actions. By, contrast, when Searle claims that impulsive or automatic actions are in some sense intentional, he has a much weaker notion of intentional action in mind. On this weaker reading, for an action to be intentional, it is sufficient that some aspects of it be conditions of satisfaction of the intentional content of the intention in action that caused it.

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I agree with Bach that these are obvious conditions of adequacy that a theory of action should meet and, twenty years later, I share his view that the causal approach is the most promising.

Obviously, the earlier versions of the Causal Theory failed to meet some of the constraints spelled out by Bach. In particular, they largely neglected the phenomenological aspects of action and they failed to offer a satisfactory account of non-deliberate actions. Moreover, they confronted the well-known problem of causal deviance. Yet, I think, the introduction by Searle (1983) of the distinction between prior intentions and intentions in action (and by other philosophers of similar distinctions[2]) has helped solve a number of those difficulties confronted by the earlier versions of the Causal Theory of Action.

It is beyond the scope of this paper to offer a defence of the conditions of adequacy set forth by Bach or to argue in favour of the causal approach. This general framework is then simply presupposed. My aim here is much more specific. Despite its usefulness, the Searlian distinction seems to me to raise problems of its own. The exact nature of the respective contents of two types of intentions as well as the nature of the relationship between these contents remains in need of further clarification. On the one hand, although it may be supposed that the content of intentions in action is a type of non-conceptual content, we still need an account of the exact nature of this content, i.e. an account of what is encoded and of how what is encoded can play a causal role in the production of behaviour. In particular, we need to examine whether, as Searle contends, the content of intentions in action includes a causally self-referential component, and how this component could be non-conceptually represented. On the other hand, although prior intentions are presumably conscious states with conceptual content, it remains unclear what makes an organism capable of forming conscious prior intentions, what is involved in the mastery of action concepts and how action concepts are related to the non-conceptual content of intentions in action.

In this paper, I would like to suggest that in our attempts to confront those issues, we could benefit from considering recent work in the neurophysiology of action, in particular work on motor intentions and motor imagery. In what follows, I first give a brief sketch of how the distinction between prior intentions and intentions in action has helped solve certain difficulties faced by the Causal Theory of Action. I'll then try to show how neurophysiological work on motor intentions and motor imagery can help us give a more precise

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[2] For instance, Brand, 1984, draws a distinction between immediate and prospective intentions, Mele, 1992, between proximal and distal intentions, Bratman, 1987, between present-directed and future-directed intentions, and Bach, 1978, between intentions and executive representations. Although they are not strictly equivalent to it, these distinctions present similarities with Searle's distinction. Indeed, Brand's and Bach's distinctions are very close to Searle's at least in the respects that will interest me in this paper. Although I shall be using Searle's terminology, which is perhaps more familiar, and discussing his account, much of what I'll say applies as well to Brand's and Bach's accounts.

account both of the content of intentions in action and of the relationship between intentions in action and prior intentions. Insofar as this account appears satisfactory, it may constitute an indirect argument in favour of the Searlian distinction, and, more generally, of the causal approach.

2. Classical Versions of the Causal Theory and their Difficulties

According to the classical versions of the Causal Theory of Action,[3] what distinguishes actions from mere happenings is the nature of their causal antecedents. Genuine actions are events with a distinctive mental cause. More precisely, according to Brand's formulation of the Causal Theory, '[a subject] *S*'s *A*ing is an action iff there is a [mental event] *M* of *S* such that (i) *M* caused *S*'s *A*ing and (ii) *M* is appropriate to *S*'s *A*ing' (1984, p. 7). The relevant causal antecedent is typically conceived as a complex of some of the subjects' beliefs and desires. According to Davidson (1963), for instance, the causal antecedent of an action is a combination of a pro-attitude toward actions of a certain kind and a belief that that kind of action can be performed. Clause (ii) says that the content of the mental event relates to the performance of an action. Assuming that *A* is the action and that the relevant mental event is a combination of a belief and a desire, this means that the desire should be a desire that one *A*s and the belief a belief that one can do so.

However, this simple version of the Causal Theory is faced with several difficulties. First, as a number of philosophers (Brand, 1984; Davis 1979; Searle 1983) have remarked, many actions, in particular automatic ones, do not seem to be preceded by any intention to perform them, at least if the intention (i.e. on the Causal Theory the belief–desire pair) is meant to be conscious or introspectively available. To borrow an example from Searle (1983), suppose I am sitting in a chair reflecting on a philosophical problem, and I suddenly get up and start pacing about the room; although my getting up and pacing about are actions of mine, in order to do them I do not need to form an intention to do them prior to doing them.

Second, the Causal Theory faces the problem of causal deviance or waywardness. To borrow an example from Davidson (1973), a climber might want to rid himself of the weight and danger of holding another man on a rope, and he might know that by loosening his hold on the rope he could rid himself of the weight and danger. This belief and want might so unnerve him as to cause him to loosen his hold. Yet it might be the case that he never chose to loosen his hold, nor did he do it intentionally. The problem here is that not

[3] The most prominent proponents of the Causal Theory are Davidson, 1963, 1973, 1978, and Goldman, 1970. The origin of the current interest in the Causal Theory can be traced back to Davidson's 1963 paper 'Actions, Reasons and Causes'. Versions of the Causal Theory have also been advocated by Sellars, 1966, 1973; Castañeda, 1975, 1980; Searle, 1979, 1983; and Brand, 1984.

every causal relation between seemingly appropriate mental antecedents and resultant events qualifies the latter as actions. The challenge then is to specify the causal connection that must hold between the antecedent mental event and the resultant behaviour for the latter to qualify as an action.

Finally, a third objection to the Causal Theory is that it fails to account for the specific features of our knowledge of our own actions (Frankfurt, 1978; Wakefield and Dreyfus, 1991). Since the Causal Theory claims that the main difference between actions and simple events lies in their causal antecedents, it implies that actions and simple events are not intrinsically different. Or, to put it otherwise, as far as the account goes, the phenomenology of bodily motion could be exactly the same in bodily movements that are caused by intentions and thus qualify as actions and in bodily movements that are not actions, such as Penfied motions caused by electrode firings in the motor cortex (Penfield, 1975). As a consequence, the theory must assume that an agent knows that she is performing an action not in virtue of her immediate awareness that she is moving, but because she knows what the antecedent conditions causing her behaviour are. Thus, the Causal Theory cannot envisage, as a criterion of action, that the agent may stand in a specific relation to her bodily movements during the time when she is presumed to be acting.

3. Searle's Dual Theory of Intentions

In order to answer those problems, Searle (1983) proposed that we distinguish between two types of intentions, what he calls intentions in action and prior intentions. In Searle's terminology, a 'prior intention' corresponds to the initial representation of the goal of the action prior to the initiation of the action. However, on Searle's account it is not enough that a bodily motion be caused by a prior intention in order for it to qualify as an action. It is moreover required that the bodily motion be caused by an intention in action, that proximately causes the physiological chain leading to overt behaviour. The label 'intention in action' is indeed quite appropriate in that it highlights an important aspect of this conception of the causation of action, namely that the intention does not terminate with the onset of action but continues until the action is completed. On this view, the intention does not simply trigger the action, it plays a continuing causal role in shaping the action, guiding and monitoring it until completion.

Let us examine how this proposal can help solve the difficulties mentioned earlier. To begin with, it provides a straightforward answer to the first problem we pointed out (that many actions do not seem to be preceded by any conscious intention to perform them). According to the revised Causal Theory, all actions have intentions in action, but they do not all have prior intentions. Moreover, although intentions in action can be conscious, that is accompanied by what Searle (1983) calls an 'experience of acting', this need not be the case. Thus, on the modified causal account, for a bit of behaviour to qualify as an

action, it is both necessary and sufficient that it be caused by an intention in action, and it does not matter whether the latter is accompanied by an experience of acting or not. The modified Causal Theory also provides at least a partial answer to the problem of causal deviance or waywardness. On this view, what is criterial for an event to qualify as an action is not that it be caused by a prior intention, but that it be caused by an intention in action. Thus, in Davidson's example, the climber's loosening his hold does not count as an action despite its being caused by a prior intention to do so,[4] because the intervening events in the causal chain that links the prior intention to the resultant bodily behaviour do not include an intention in action that one performs that bodily movement. However, for a complete answer to the problem of causal deviance to be provided, more needs to be said. In cases where the agent is acting on his prior intention, there must be a close connection between the prior intention and the intention in action and we need to spell out what this connection is.

The revised Causal Theory also seems to answer the third objection concerning our knowledge of our own actions. Insofar as the intention in action is involved in the guidance and monitoring of the action, it does not terminate with the onset of action, but continues as long as the guidance and monitoring continues. As a consequence, it seems possible to reconcile the view that the main difference between actions and simple events lies in their causal antecedents with the idea that we are immediately aware that we are acting and that this awareness has a non-perceptual source. According to the Searlian account, this awareness takes the form of an experience of acting, that is a conscious presentation of the intentional content of the intention in action. More precisely, what makes it the case that this conscious presentation of the content of the intention in action is an experience of acting (rather than an experience of a bodily motion that may or may not be an action) is the fact that the content of intentions in action includes a causally self-referential component. In other words, it is part of the content of an intention in action that this intention in action causes certain bodily motions. Thus, the experience of acting contains within it the experience that the bodily motion is being caused by the intention in action. I shall say more presently about the causal self-referentiality of intentions.[5]

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[4] Actually, unless it is assumed that prior intentions reduce to belief–desire pairs, one can even deny that in the climber's case a prior intention is present.

[5] As Searle insists, this awareness of acting should not be confused with the perceptual awareness (proprioceptive or otherwise) of our bodily movements. There can be an experience of acting without there being actual bodily movements, as in the famous case described by William James, 1950, where a patient with an anaesthetized arm is asked to close his eyes and then to raise his arm. Unknown to him his arm is held to prevent it from moving and when he opens his eyes, he is surprised to discover that there was no arm movement. Conversely, a patient can be caused to move his hand by applying an electrode to the motor cortex of one hemisphere (Penfield, 1975), in which case the patients feels his arm moving but reports no experience of acting.

Prima facie, then, the Searlian account seems more promising than the standard Davidsonian account. Via the concept of the intention in action, Searle seems able to provide solutions to problems encountered by the standard account. Yet, the Searlian account poses problems of its own. For once a distinction is posited between two types of intentions, one must answer the question how they are connected. And before one tries to answer this question, one must have a precise characterization of each type of intention. So let's see first what are the characterizations Searle offers and second what further elaborations may to be needed and how they might be provided.

4. The Searlian Characterization of Intentions in Action and Prior Intentions

Searle characterizes both intentions in action and prior intentions in terms of their intentional content, as given by their conditions of satisfaction, where the expression 'conditions of satisfaction' makes reference to the requirements that have to be met, and not to the things that meet those requirements. The characterization he offers is the following:

> the contents of the prior intention and the intention in action look quite different, because, though both are causally self-referential, the prior intention represents the whole action as the rest of its conditions of satisfaction, but the intention in action presents, but does not *re*p-resent, the physical movement and not the whole action as the rest of its conditions of satisfaction. In the former case the whole action is the 'Intentional object'; in the latter case the movement is the 'Intentional object'. [. . .] Another difference is that in any real-life situation the intention in action will be much more determinate than the prior intention. (1983, p. 93)

Let us examine each of these points in turn. Searle first notes that both prior intentions and intentions in action are causally self-referential: that is, their conditions of satisfaction require that the intentional states themselves play a causal role in bringing about the rest of their conditions of satisfaction. Causal self-referentiality is a feature intentions share with perceptions, although in the case of perception the direction of causation is reversed. Searle draws a distinction between features of content which function to determine conditions of satisfaction and features outside the content which also serve to fix the conditions of satisfaction. He is quite explicit, however, in claiming that the causal self-referentiality belongs with the conditions of satisfaction that are internal to content. A number of philosophers (Armstrong, 1991; Burge, 1991; McDowell, 1991) have objected to this analysis of the causal self-referentiality of perceptions and intentions. Although they agree that Searle is right to include causal self-referentiality as part of the conditions of satisfaction of those

states, they think that by making this condition of satisfaction internal to the intentional content, he attributes too complicated or too sophisticated an intentional content to visual experiences and experiences of acting. Searle's reply to this objection appeals to a distinction between what is represented and how what is represented is represented. A misunderstanding arises, according to Searle, because his critics take the theoretical specifications he offers of the content of intentions or perceptions as specifications both of what is represented and how it is represented. But the mode of presentation of the conditions of satisfaction of an intention in a theoretical exposition of the intentional content of intentions is a second-order characterization and need not be (and presumably is not) the mode of presentation under which the conditions of satisfaction are represented in the intentional content of an intention. As Searle puts it: 'An agent may have a conscious Intentional content and that Intentional content may determine the conditions of satisfaction under certain aspects, that is with a certain "mode of presentation", where the agent may not himself have a second-order awareness of how the conscious Intentional content functions to determine the conditions of satisfaction under those aspects' (1991, p. 231). Applied to the case of self-referentiality, this means that from the fact that the causal self-referentiality is a feature of the intentional content of intentions, it does not follow that the agent has to have the concept of causal self-referentiality, second-order or demonstrative references to his intentions, or thoughts about causation in order to have intentions. Searle is certainly right to claim that we should distinguish between a second-order representation of the conditions of satisfaction offered in a theoretical analysis and the first-order representational facts. However, his case for making causal self-referentiality a condition of satisfaction internal to content rather than simply external would be made more convincing if he could provide a (second-order) characterization of the mode of presentation of the intended bodily movement that makes clear how this causal self-referentiality can be part of this mode of presentation. In what follows I shall offer a tentative characterization of the mode of presentation of actions in intentions in action. We will then be in a position to examine whether, given this characterization, Searle's contention can be sustained. But first let us pursue the characterization of intentions in action and prior intentions.

Searle points out three differences between intentions in action and prior intentions. The first difference concerns the rest of their conditions of satisfaction. Searle claims that whereas the content of intentions in action presents physical movements, the content of prior intentions represents whole actions, that is, not just a physical movement, but the causal sequence consisting of the intention in action causing the physical movement. Thus, to borrow one of his examples, the conditions of satisfaction of my prior intention to raise my arm can be expressed as follows:

> An intention in action which is a presentation of my arm going up causes my arm to go up as a result of this prior intention.

By contrast, the condition of satisfaction of the intention in action is simply that:

My arm goes up as a result of this intention in action.

The second difference between prior intentions and intentions in action is that the former represent their conditions of satisfaction whereas the latter present them. Searle first introduces the distinction between presentations and representations in a discussion of perceptual intentionality, in order to mark a contrast between the ways in which perceptual experiences and beliefs are related to their objects. Perceptual experience is said to provide a direct access to its object. As Searle puts it, 'The experience has a kind of directness, immediacy and involuntariness which is not shared by a belief I might have about the object in its absence. It seems therefore unnatural to describe visual experiences as representations' (1983, p. 46). Searle later draws an analogy between perception and action, claiming that the formal relations between the visual memory of a flower, the visual experience of the flower, and the flower are the mirror images of the relations between the prior intention to raise my arm, the intention in action of raising my arm and my arm rising. In particular, the prior intention (representation) is to the intention in action (presentation) as the perceptual memory (representation) is to the perceptual experience (presentation).

Finally, Searle points out that the content of an intention in action is much more determinate than the content of a prior intention, meaning that my intention in action to raise my arm, for instance, will include not only that my arm goes up, but that it goes up in a certain way, at a certain speed, etc. Although he does not expand on this point, I think it is essential. Indeed, what is at stake is not merely a difference in the degree of determinacy insofar as such a difference could be cancelled by spelling out the prior intention in more detail; rather, it is a difference in the representational mode used to specify the content. The content of a prior intention contains a description of a type of action. It is a kind of conceptual content. By contrast, the content of the intention in action is a kind of non-conceptual content.[6] I could raise my arm slowly or rapidly, I could raise my arm by first raising my hand, then my forearm and then my arm or I could run this sequence in the reverse

[6] It is important to note that although the non-conceptual nature of the content of intentions in action can be inferred from the characterization Searle offers of this content, Searle never explicitly makes this claim. Of course, the phrase 'non-conceptual content' has only recently gained wide currency. Although he does not use this phrase either, Bach (1978), whose distinction between intentions and executive representations is roughly similar to Searle's distinction between prior intentions and intentions in action, is more explicit than Searle in his characterization of executive representations. He claims that they are not propositional in form, that they are not linguistic or discursive in character, but intuitive or sensuous. He also contends that they lack the conceptualization involved in intentions.

order. Different intentions in action would have to cause these movements, but they would all satisfy the description 'my raising my arm'. In order to make this point clearer, we can draw the analogy between perception and action in a way slightly different from Searle's, saying that the prior intention is to the intention in action as the perceptual belief (rather than the perceptual memory) is to the perceptual experience. To adapt an example from Peacocke (1992), if you are looking at a range of mountains, you may form the perceptual belief that some are rounded, some are jagged. But the content of your visual experience in respect to the shape of the mountains is far more specific than that description suggests. The perceptual belief involving the concepts *round* and *jagged* would cover many different fine-grained contents that your experience could have. Similarly, my prior intention to raise my arm, where the action concept *raising one's arm* is a component of the content of the prior intention covers many fine-grained contents that the corresponding intention in action could have. And although we could use very fine-grained concepts to try to capture the fine-grained content of the intention in action, this does not entail that these concepts themselves are somehow components of the content of the intention in action nor that the concepts must be possessed by the agent for him to perform the intention in action. Otherwise, we would have to deny that young children or non-human animals who presumably lack concepts are capable of action. Moreover, as we have already seen in our discussion of self-referentiality, we have reasons to think that if there is a self-referential component of the content, this component is represented in a non-conceptual way.

If the present characterization of intentions in action and prior intentions, based on Searle's analysis, is on the right track, the fact that an organism be capable of acting and thus that it have intentions in action is no warranty that it be capable of forming conscious prior intentions. The content of the prior intention represents the whole action; that is, it involves both a representation of the intention in action and a description of the physical movements that this intention in action is to cause—i.e. a representation of the content of the intention in action. Moreover, whereas the (re)presentational content of the intention in action is a non-conceptual kind of content, its description at the level of the prior intention makes use of action concepts. Thus, for an organism to be able to form prior intentions, it is moreover required that it have some conscious grasp of what an intention in action is and that it possess action concepts. As a consequence, our Searle-based account of the formal relationships between prior intentions and intentions in action needs to be supplemented in at least three ways. First, we need an account of the non-conceptual content of intentions in action that makes clear exactly what it could mean to say that causal self-referentiality is internal to this content. Second, we need an explanation of what makes it possible for an organism to have a conscious grasp of its intentions in action and of their role in bringing about actions.

Third, we need an explanation of how action concepts are related to the non-conceptual content of intentions in action.

5. Motor Representations and the Non-Conceptual Content of Intentions in Action

It seems that in our attempts to confront those issues, we could benefit from the insights provided by recent work in the neurophysiology of action. In a very stimulating synthesis of an important body of neurophysiological studies on the nature of motor intention and imagery, Jeannerod (1994a, 1997) provides evidence in favour of the following four theses.

(1) Actions are driven by an internally represented goal rather than directly by the external world.
(2) Motor representations have a specific content, involving two main aspects: a representation of the body in action as a generator of forces and a representation of a goal of action encoded in a '*pragmatic*' mode, distinct from '*semantic*' modes of representation.
(3) There exists a close functional equivalence between motor preparation and motor imagery. In particular, the motor representations used in first-person motor imagery can be viewed—modulo certain qualifications—as the conscious counterparts of the representations constructed during motor preparation.
(4) The motor representations activated during motor preparation for (and motor imagery of) a specific action are also activated when the subject observes someone else performing the same action.

The first thesis emphasizes a central version of the motor theory insofar as motor intentions are thought to be largely endogenous rather than generated by peripheral mechanisms propagating to central levels. This is not to deny that motor representations can rely, at least in part, on knowledge that is the result of our experience of the outside world, but it is to claim that there is no direct transformation of perceptual input into outgoing activity. A representational step intervenes that must involve the two components stated in thesis (2).

The second thesis is of immediate relevance to the first problem at hand: providing a characterization of the non-conceptual content of intentions in action. The reason for equating Searle's intentions in action with Jeannerod's motor representations is that they are assigned the same function in both models, i.e. they are the proximal causes of actions and they play a continuing causal role in shaping the action, guiding and monitoring it until completion. The thesis picks out two complementary aspects of the content of motor representations. The first concerns the representation of the body in action. Jeannerod points out that the motor representation is a representation of the acting

self that involves a representation of the body as a generator of acting forces, not just a representation of the effects of those forces on the external world. Experimental studies reviewed by Jeannerod (Decety et al., 1993; Gandevia, 1982, 1987; Gandevia and McCloskey, 1977; McCloskey et al., 1983) suggest that the amount of force needed to produce the desired motor effect is encoded in this component of the representation. Moreover, experiments with completely, or partially, paralysed patients (Gandevia 1982; Jeannerod 1994b; Scheerer 1987) suggest that the programming of force has a subjective correlate—the sensation of effort. Empirical evidence also suggests that the central representation of action encodes certain parameters of movement execution dictated by kinematic rules (Decety and Michel, 1989; Georgopoulos and Massey, 1987; Georgopoulos et al., 1989; Viviani and McCollum, 1983) and biomechanical constraints (Rosenbaum et al., 1990; Rosenbaum and Jorgensen, 1992; Shiffrar and Freyd, 1990).

The second essential aspect of a motor representation is a representation of the goal of action. In accordance with the 'schema' theory of action, Jeannerod develops the idea that this goal-related component of the motor representation includes a representation of both the external object toward which it is directed, and the final state of the organism when that object has been reached. In simple, object-oriented actions (i.e., when objects are goals for actions), the visual attributes of those objects are represented in a specific, pragmatic mode used for the selection of appropriate movements and distinct from other modes of representation used for other aspects of object-oriented behaviour (categorization, recognition, etc.). Jeannerod's distinction between pragmatic and semantic modes of visual processing has its roots in Ungerleider and Mishkin's (1982) distinction between 'what' and 'where' systems of visual information processing, involved in the processing of object perception and in the processing of spatial analysis, respectively. According to the classical formulation of the distinction, the 'where' system, corresponding to the cortical dorsal pathway, handles the processing of all visuospatial information, whether coded in viewer-centred coordinates or not, whereas the 'what' system corresponding to the ventral cortical pathway is specialized in the processing of information concerning object identification—thus enabling recognition and individuation—and codes this information in object-centred coordinates.

Jeannerod accepts the idea of a 'what' system, responsible for what he calls the semantic mode of object representation and corresponding to the ventral cortical pathway where objects are described in object-centred coordinates. His notion of pragmatic processing, however, does not correspond to the 'where' system, as traditionally construed. First, Jeannerod contends that the motor representation includes much more than the spatial aspects of the movements. He draws a distinction between spatially oriented actions (like reaching), which are coded in viewer-centred coordinates, and object-oriented actions (like grasping and manipulating), which, in his view, involve a rep-

resentation of the shape of the object using an object-centred system of coordinates. Given the tight coordination between the different arm segments involved in reaching and in grasping, it follows, according to Jeannerod, that an essential aspect of object-oriented behaviour is that the same object has to be simultaneously represented in multiple ways. Second, he contends that recent neurological data point to a division of labour between the ventral and dorsal pathways that differs from what was initially suggested by Ungerleider and Mishkin (1982). Thus, Goodale et al. (1991) reported the case of a patient whose lesion was likely to have interrupted the ventral pathway. Although the patient was unable to recognize objects, she was quite accurate when instructed to take these target objects. Not only was she able to reach the object location, but she also preshaped her hand accurately according to the object's size and shape.[7] By contrast, lesions in the dorsal pathway do not alter object recognition but they alter arm movement during reaching as well as finger movements during preshaping and grasping (Perenin and Vighetto, 1988; Jeannerod, 1986; Jakobson et al., 1991). According to Jeannerod, the existence of such double dissociations confirms the hypothesis of selective semantic and pragmatic representation mechanisms and suggests that the dorsal pathway is involved not only in spatial processing but also in pragmatic processing. Thus, whereas Jeannerod's notion of semantic processing corresponds to the 'what' system, his system for pragmatic processing is not equivalent to the 'where' system. Rather it constitutes a third kind of information processing, which could be called a 'how' system. Pragmatic representations differ from 'where' representations narrowly conceived insofar as (i) they encode not only information about object location, but also information about object attributes and (ii) they encode this latter kind of information in object-centred coordinates. They differ from 'what' or semantic representations in that (i) they are mainly processed in the dorsal pathway rather than in the ventral pathway, and (ii) they provide information for visually guided action rather than for visual identification.[8] Yet, it should be noted that this dichotomous distinction between two visual systems, one dedicated to action and the other to perception, is an oversimplification that bears qualification. As pointed by Milner and Goodale (1995) and Jeannerod (1997) the anatomical and physiological organization of the two systems does not fully support the conception of a separate functioning. Moreover, the capacity to perform an appropriate object-oriented action may depend on information processed by the semantic system.

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[7] Interestingly, this patient was later found by Dijkerman and Milner, 1997, to be able to exploit motor imagery to help her remedy her impoverished visual perception. She could copy drawings of lines as if she could perceive them, provided she was given time to construct a mental image of herself tracing over them; if not given this opportunity, her drawings were random. Yet, she had no perceptual experience of the lines.

[8] It should be noted that Milner and Goodale, 1993, proposed an account of the two visual processing systems very similar to Jeannerod, though different in detail. This account was further elaborated in Milner and Goodale, 1995, and Milner, 1997.

For instance, in order to pick a red apple among green ones, the pragmatic system must have access to information about colour processed by the ventral system. This indicates that the two systems are not fully separate but rather complementary. Thus, although the ventral system is mainly responsible for the construction of semantic representations and the dorsal system for the construction of pragmatic representation, it may be better not to make the distinction between semantic and pragmatic representations strictly dependent on this anatomical dichotomy.

In order to get clearer as to what exactly is meant by pragmatic representations, one can appeal to Campbell's notion of causal indexicality (Campbell, 1993, 1994). Campbell points out that many notions are causally significant insofar as judgements made using them have some significance for the ways in which the world will behave, and for how it would behave in various possible circumstances. A subclass of those notions has the further characteristic that grasp of their causal significance consists in one's practical grasp of their immediate implications for one's own actions. Notions in this subclass are what Campbell calls causally indexical notions. Predicates such as 'is a weight I can easily lift', 'is too hot for me to handle' or 'is within my reach' are offered by Campbell as examples of causally indexical predicates.[9] He notes, however, that although these examples make use of the first person and use notions of weight and temperature, use of indexical terms need not depend upon self-consciousness or grasp of non-indexical notions. Thus, unstructured uses of 'is heavy', 'is hot' or 'is within reach' may be taken as more primitive examples of causally indexical terms insofar as they have immediate implications for the subject's actions. Campbell's notion of causal indexicality fits nicely with Jeannerod's idea of a pragmatic mode of representation of objects and I think it would not be betraying Jeannerod's position to say that pragmatic representations of objects are causally indexical representations, where object attributes are treated in terms of their immediate implications for action, that is to the extent to which they afford specific motor patterns. Thus, Jeannerod's claim that a large number of object attributes (shape, size, compliance, texture, and so on) are relevant to both pragmatic and semantic representations, could be rephrased using Campbell's terminology by saying that those attributes can be represented in either a causally indexical or in a non-indexical way. For instance, the same shape could be represented as 'an elongated rectangle' (semantic mode) or as 'graspable with thumb and forefinger' (pragmatic mode).

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[9] The case of weight provides an illustration of the fact that not all the visual processing that might be subsumed as 'causally indexical' in Campbell's terms or 'pragmatic' in Jeannerod's is linked to the dorsal pathway. Certain visual illusions deceive our perceptual experience of size (ventral stream) without affecting our visuomotor control of finger opening, suggesting that the dorsal stream is not vulnerable to them (Goodale and Haffenden, 1998). Yet these illusions do affect our grip force, presumably because the illusion causes us to misjudge their weight (Brenner and Smeets, 1996). Thus, properties such as 'too heavy to lift' probably depend on processing in the ventral stream.

To sum up, Jeannerod suggests that a motor representation of a goal object includes both a visuospatial component pertaining to its spatial location and an object-centred component determining how to deal with it. He also suggests that the function of those representations 'falls between' a sensory function (extracting from the environment attributes of objects or situations relevant to a given action) and a motor one (encoding certain aspects of that action). In other words, in a pragmatic representation, object attributes are treated in a causally indexical way, or, to use a different terminology, as 'affordances' (Gibson, 1979), activating predetermined motor patterns.

Jeannerod suggests that the same general framework used for simple object-oriented actions remains applicable to higher-order representations encoding long-term action plans. The lower-level object-oriented motor representations should be considered as constituents of more complex action representations, that will also need to involve higher-order schemas for controlling the selection, the activation, the inhibition, and the sequencing of elementary motor schemas.

Although for expository purposes I distinguished between two aspects of the content of motor representations, it would be mistaken to assume that they correspond to two separate components of the content. Rather, motor representations as conceived of by Jeannerod should be viewed as relational models, with the body and the goal functioning as the terms of the relation. What the motor representation represents are neither states of the body per se nor states of the environment per se, but rather dynamic relations between body and goal. As another way to put it, we could say that the goal is given under a specific mode of presentation, namely the form of a process.

There is yet a second, different sense, in which the mode of presentation of the content of intentions in action is relational and dynamical. Motor representations include perceptual[10] information both about the external world (e.g. the position in space and the shape of the object-goal) and about the agent's body (e.g. kinaesthetic and proprioceptive information about the position of the limbs). Insofar as motor representations include perceptual representations, they include non-descriptive modes of presentation. Here non-descriptiveness should be taken in both of the two senses distinguished by Recanati (1993). First, the mode of presentation is non-descriptive in the sense that it is iconic, where iconicity is analysed in terms of three characteristic properties: perspectivalness, significant degree of isomorphism between the representation and its object, and analog encoding of information. Second, the mode of presentation is non-descriptive in the sense that it is a *de re* mode of presentation, where *de re* modes of presentation are construed as mental indexicals that determine the contextual relation that something must bear to

[10] Here 'perceptual' refers to the sensory information processed in the dorsal pathway as well as to the visual information processed by the ventral stream insofar as it influences action and is used for the construction of pragmatic representations.

a thought to be the object of the thought (Recanati, 1993, pp. 98–103). This gives us the second sense in which we can say that the modes of presentation of the content of intentions in action are relational. They are relational insofar as they include *de re* modes of presentation, that is modes of presentation that involve a certain relation to the reference.

Let us now examine what the second sense is in which the modes of presentation of the content of intentions in action can be said to be dynamical. Recall that it is an essential characteristic of the role of intentions that they be involved in the guiding and monitoring of the action as long as it unfolds. How is this essential feature of intentions in action reflected in their content? In order for the intention in action to guide the action, it must anticipate the consequences of the movements. In order to control it, it must allow for adjustments during execution. As a consequence, the content of the intention in action cannot be fully determined prior to the initiation of action. To take a very simple example, if my intention in action is to take a drink from the glass of water in front of me, its content will include that I reach for the glass, that I grasp it and that I lift it. My representation will include estimates as to what the trajectory of my arm should be for it to reach the glass, estimates as to how my hand should be shaped in order to grasp the glass, estimates as to the amount of force needed to lift it. However, feedback (be it visual, kinaesthetic, or proprioceptive) will be needed to make adjustments. Here the content of the intention is dynamical in the sense both that it gets elaborated over time—it becomes more determinate through feedback—and that the intention in action is itself responsible for obtaining the information that will make the content more determinate. The only way to gain the extra information (the feedback information) is for the intention in action to create the context in which the information will be available. Perhaps we could say here (if one is not already overdosing on indexicality) that an important feature of the content of intentions in action is its dynamical indexicality. Indexicality because the exact value of certain constituents of the representation (amount of force that needs to be programmed, precise shape of the hand, and so on) can only be fixed relative to a context. Dynamical indexicality because the context itself must be brought into existence by the intention in action.

6. Are Intentions in Action Causally Self-Referential?

Let us now go back to the question of the causal self-referentiality of intentions in action. Does the characterization just offered of the content of intentions in action and of its mode of presentation support Searle's contention that the causal self-referentiality of intentions in action is internal to its content? One way to proceed is to try to construct situations where an agent has an intention in action to *A*, the agent *A*s, but the agent's *A*ing does not count as satisfying the intention to *A* and to see what we would say went wrong. Here is a first case. Let us say at the outset that this case fails to satisfy the requirements just

put forward. However, the reasons for the failure are instructive. This case is a free adaptation of an example of Searle's. Imagine a man with electrodes on his scalp that record electrical brain events that are known to be correlated with the formation of an intention in action. The electrodes are connected to a switch which activates a magnet in the ceiling which attracts the metal of the watch on his wrist which raises his arm. When the man forms the intention in action to raise his arm, the correlated brain activity is recorded by the electrodes, the switch is turned on, and his arm rises. Notice that what happens satisfies the content of the intention in action of raising one's arm as given by Searle: one's arm goes up as a result of this intention in action (1983, p. 93). Yet we are reluctant to consider this as a *bona fide* case of a satisfied intention in action, and so is Searle. Why? The obvious answer is that the intention in action does not cause the action in the right way. Searle's characterization of the conditions of satisfaction of the intention in action is incomplete. The content of the intention is not just that my arm goes up, it is that my arm goes up as a result of a certain causal process. The form of the process is precisely given by the mode of presentation of the bodily movement. So it seems that a more adequate characterization of the conditions of satisfaction of the intention would be something like: this intention in action causes such and such an internal process that results in my arm going up. Obviously, in the present case these conditions are not satisfied, the process through which the arm goes up is not the process represented in the content of the intention in action. Now one may wonder whether the solution to the problem of the self-referentiality does not simply lie in the fact that, given the way organisms are built, the kind of processes that are represented in intentions in action can only be caused by the intentions in action that represent them. If such is the case, it might seem that the explicit mention of the causal self-referentiality of the intention among the conditions of satisfaction is redundant, the causal self-referentiality is already built in the mode of presentation (the form of a process) of the movement. The conditions of satisfaction of my intention to raise my arm would then simply be that there is a specific process resulting in my arm going up.

Although this solution may appear tempting, there is a *prima facie* counter-example to it. So here is a second case: suppose that talking makes me thirsty and that I form the intention in action to take a drink from the glass in front of me. As I am about to perform that action, a sudden very loud noise in the back of the room startles me, some confusion ensues, and I forget completely about my intention. Five minutes later though, when the calm is restored, I form a second intention in action to drink and I act accordingly. Is my first intention in action thereby satisfied? It seems that if my bodily position and the position of the glass relative to me are exactly the same when I form the second intention, then the process of bringing the glass to my lips as represented in the second intention in action will be exactly the same as the process represented in my first intention in action. Hence, if the condition of

satisfaction of my intentions in action in both cases is simply that the process obtains, both my intentions in action should be said to be satisfied. Intuitively, there is something wrong with that: I acted on my second intention in action but I did not act on my first intention in action. So it seems that there is more to the causal self-referentiality of intentions than what may be built in in the mode of presentation of the bodily movement. For my first intention in action to be satisfied, it is not enough that some token of the same type of intention be satisfied, it is this very token that must be satisfied. There is a token-reflexivity of intentions in action that has not yet been accounted for. Does this mean that we have to reintroduce in the content of the intention in action the explicit causally self-referential component that we thought we could dispense with?

Maybe not. Maybe the whole intention in action inherits its token-reflexivity from the token-reflexivity of some other component of the content. What candidates are there? Recall that I distinguished earlier between two senses in which the modes of presentation of intentions are relational. They are relational in the first sense in that they represent not just states of the body or states of the environment, but relations between the two kinds of states. They are relational in the second sense in that they include perceptual information about the body and the environment, hence constituents whose mode of presentation is *de re*. For an intention in action to be satisfied, it must be the case that these constituents are related to their references in a certain way. In particular in the case of perceptual modes of presentation, it must be the case that a certain causal–temporal relation obtains between the content of my perceptual state and some state of the world. In the case of my first intention in action to drink from the glass, this relation does not obtain. The glass being in front of me at 10.05 is not what makes true my perception of the glass at 10.00. Hence what happens at 10.05 cannot be what satisfies my first intention in action. So we might want to say that the whole intention in action inherits its token-reflexivity from the token-reflexivity of the perceptual components of its content and that this is all that is needed.

But there seems to be a problem with this proposal. After all, when I formed my first intention in action to drink from the glass in front of me at 10.00, there was indeed a glass of water in front of me. So we may say that my first intention in action was satisfied in part because of what was the case at 10.00 (I was related in the right way to the glass of water) and in part because of what happened five minutes later. But of course we don't want to say that. This suggests that the token-reflexivity of the perceptual constituents of the content of the intention in action is not enough to warrant the token-reflexivity of the whole intention and that we need something more. But maybe this counter-example to the analysis is only apparent. In formulating it we lost sight of the other important feature of the modes of presentation of intentions in action: namely that they take the form of a process. The perceptual constituents are represented as elements of a process, causally related to other elements.

Recall that in intentions in action, perceptual information is represented in a specific pragmatic format, in a causally indexical way, that leads to the activation of certain motor schemas. Recall also this aspect of motor representations that I called their dynamical indexicality: part of the perceptual content of the intention in action (the feedback information) is represented as made available by earlier steps in the process. Our purported counter-example fails, because, in the situation as described, the conditions of satisfaction of the first intention in action are not all satisfied. For the intention to be satisfied it would have to be the case not only that my perception of the glass at 10.00 be veridical, but also that it be part of the process resulting in my reaching for the glass, grasping it and so on. This second condition does not obtain.

If these proposals concerning the mode of presentation of the content of intentions in action are correct, they provide us with a reductive analysis of the causal self-referentiality of intentions in action. To put it bluntly, the causal self-referentiality should be decomposed into two parts: the causal part and the self-referential part. The causal part is taken care of by the fact that intentions in action represent actions in a certain way, namely as certain processes, and only states that represent actions in this way can cause them under those aspects. The self-referentiality part is taken care of by the fact that the content of intentions in action includes perceptual elements that are token-reflexive and that, when successful, anchor the whole intention in action to a certain context. The two parts are held together by the fact that the token-reflexive constituents of the content are also represented as elements of the process. Does this reductive analysis vindicate Searle's contention that causal self-referentiality is internal to the content? Yes and no. Yes, since causal self-referentiality appears to be a consequence of certain properties of the content of intentions in action. No, if what Searle meant was that causal self-referentiality was a *sui generis* irreducible component of the content of intentions.

7. Awareness of Agency

Let us now go back to our two problems concerning the relationship between intentions in action and prior intentions. What we need to do is to bridge the gap between prior intentions and intentions in action. Given the analysis of the relationships between prior intentions and intentions in action that was set forth earlier, this means that we must explain both how it is possible for an organism to have a conscious grasp of its intentions in action and of their role in bringing about actions and how its mastery of action concepts is related to the non-conceptual content of its intentions in action. Here is where Jeannerod's third and fourth theses become relevant.

His third thesis suggests that there exists a close equivalence between motor preparation and motor imagery, conceived as a type of internal imagery, a first-person process pertaining to the representation of the self in action, with the subject feeling him- or herself executing a given action. Jeannerod's con-

ception of motor imagery is based on an analogy with visual imagery. A great deal of data on visual imagery suggests that mental images retain a number of the visual and spatial characteristics of visual perception. Jeannerod considers that this interpretation of visual imagery could be generalized to mental representations in other modalities and, specifically, to motor imagery. As he puts it: 'Motor imagery would accordingly be part of a broader phenomenon (the motor representation) related to intending and preparing movements' (1994a, p. 189). Jeannerod insists that a clear distinction should be drawn between motor imagery and other kinds of imagery including dynamic visual imagery, such as mental rotation. In order to delimit his use of the term motor imagery, he appeals to the internal and external imagery distinction used by sports psychologists. According to sports psychologists (Mahoney and Avener, 1987), internal imagery is a first-person process involving mostly a kinaesthetic representation of the action, whereas external imagery is a third-person process involving a visual representation of that action or of the space in which it takes place. Jeannerod conceives of motor imagery as belonging to the former type, i.e. as pertaining to the self in action, with the subject feeling himself executing a given action. Examples of motor imagery tasks would be imagining oneself walking to a target placed at a given distance (Decety et al., 1989), imagining catching a ball, or imagining writing one's name. Jeannerod acknowledges, however, that since motor imagery often relates to actions taking place within represented visual space, it cannot be entirely segregated from visual imagery.

Three different sources of empirical evidence support Jeannerod's claim of a functional equivalence between motor preparation and motor imagery. First, motor imagery has been found to have positive effects on motor learning and training (for a review, see Feltz and Landers, 1983). Second, motor preparation and imagery have been shown to share the same neural mechanisms. In particular, the supplementary motor area is activated during both imagined and executed movements (Fox et al., 1987). Third, the same physiological correlates (increased heart rate and pulmonary ventilation) have been found in both motor imagery and preparation (for a review, see Requin et al., 1991).

According to Jeannerod, what distinguishes motor imagery from motor preparation, besides the obvious fact that the latter but not the former is followed by actual execution, is that they have different subjective contents. Motor preparation is an entirely non-conscious process of which only the final result is open to the subject's judgement, whereas, by contrast, the content of motor images can be accessed consciously. Jeannerod thinks, however, that this difference might be one of degree rather than of kind and suggests that the transition from non-conscious to conscious is a matter of timing: a certain amount of time is needed for motor representations to access consciousness. In the case of an actually executed action, the content of the motor representation would not reach consciousness because it would be cancelled as soon as the corresponding movements were executed (perhaps by the incoming

signals generated by the execution itself). By contrast, in cases where execution is blocked or delayed the representation would be protected from cancellation and would become accessible to conscious processing.

It is important to clarify the status of motor representations and motor images with respect to the whole of motor preparation. According to Jeannerod, the representation of the action is distributed at several levels of the action system. More precisely, there is a hierarchy of motor representations such that the goals and parameters of the actions coded for at the higher levels act as constraints on the lower levels of motor representation. One way to think of this motor organization is to draw an analogy with visual processing, where the relations between levels of motor preparation are the mirror images of the relations between levels of perceptual processing. That is, whereas in visual processing the flow of constraints travels mainly in an ascending fashion, with the output of lower levels serving as input for higher levels, in motor preparation the flow of constraints travels mainly in the opposite direction, with the parameters encoded at the higher levels constraining the way processes operate at lower levels.

Another aspect of the analogy with visual processing concerns the accessibility to consciousness of the content of representations computed at different levels of processing. In the case of vision, only representations computed at higher levels of visual processing seem to be accessible to consciousness.[11] Thus, according to Jackendoff (1987), the content of the conscious visual experience corresponds to the $2\frac{1}{2}$ D sketch in Marr's theory of vision (Marr, 1982); by contrast, neither the content of the primal sketch nor the content of the 2D sketch is consciously accessible. Since we know much less about motor processing and its organization, it would be premature to claim that only representations at such or such level of motor processing are consciously accessible. It remains however reasonable to assume that aspects of movements that are encoded at higher levels of motor representations will be more easily accessed than aspects encoded at lower levels. Hence, the content of motor images will presumably correspond to the content of the higher levels of motor representation.

Let us now consider the first of our two remaining problems. Given that, according to Searle, prior intentions are conscious in the sense that we have conscious access to their contents and given, moreover, that the content of a prior intention to *A* (let's say) is that this very intention causes an intention in action that in turn causes the bodily movements appropriate to *A*ing, it follows that for it to be possible that an organism form a conscious prior intention, it must be able to have a conscious grasp of its intentions in action and

[11] It has been argued by Milner and Goodale, 1995, that only activity in the ventral pathway can give rise to visual consciousness. They contend that 'higher levels' of the dorsal pathway probably can't, their purely pragmatic functions proceeding without the need for visual awareness.

of their role in bringing about actions. The problem is to explain how this is possible.

I would like to suggest that a key element to the solution of this problem is Jeannerod's notion of a conscious motor image. As we have just seen, according to Jeannerod, the motor image is the conscious counterpart of the internal motor representation. More precisely, the content of the motor representation (that is normally unconscious) becomes conscious when execution is blocked or delayed or when the action fails. Motor intentions, as we have seen, are relational models that include both information about the external world—the objects in the world towards which the action is directed and the final state of the environment once the goal is attained—and information about the agent him- or herself as a generator of acting forces. Thus, when the unconscious motor intention gets converted into a conscious motor image, the subject becomes aware not just of what is being intended (the goal) but of his or her body as a generator of acting forces. Of course this does not mean that the motor image, by itself, provides the agent with a *concept* of him- or herself as an agent, and with concepts of action, but it provides him or her with some form of conscious, though non-conceptual, grasp of his or her agency.

Indeed, the fact—if it is a fact—that the motor representation becomes conscious when execution is delayed or blocked presents an important advantage. In the normal case (when the action succeeds), the motor intention (the cause) is concomitant with the movement (its effect). When execution is blocked or delayed, the intention in action is temporally separated from its effect. Thus, motor images would give us conscious access to the intention in action in its purest form, uncontaminated by feedback linked to execution. It may then be suggested that the temporal gap between the intention in action, that gets converted into a conscious motor image, and the execution is what allows one to build a notion of oneself as the agent responsible for the continuity between intention and action.

Although Jeannerod stresses that motor preparation is normally unconscious and that consciousness of the motor representation is brought about by blocking or delay of the action, one should not jump to the conclusion that only failed or delayed actions are experienced as actions. Indeed, it does not seem right to say that we only feel responsible for our failed attempts! Two points are in order. First, it seems likely that the notion of attention has an important role to play here and that blocking or delay may matter only because they draw attention to the motor representation and its content. This would allow for the possibility of other ways in which attention could be drawn to the action, so that one might voluntarily bring to consciousness the content of a motor representation. Yet, blocking and delay may retain some form of priority, insofar as, presumably, one cannot voluntarily attend to something the existence of which one is totally unaware. Blocking or delay may thus be what makes us aware of the existence of motor representations in the first place.

Second, it does not feel right either to say that only actions we are attending to in one way or another are experienced as our own. It seems that even our successful automatic actions are dimly experienced as our own actions. Here, following Wakefield and Dreyfus (1991), we may draw a distinction between knowing what we are doing and knowing that we are acting. As these authors point out: 'Although at certain times during an action we may not know what we are doing, we do always seem to know during an action that we are acting, at least in the sense that we experience ourselves as acting rather than as being passively moved about' (1991, p. 268). This distinction between two forms of experience of acting may be accounted for in terms of the levels of action-monitoring involved. Several current models of action control distinguish between at least two levels of action-monitoring (Frith, 1992, 1995; Jeannerod, 1997; Wolpert et al., 1995) and recent experimental data suggest the need for three-tiered models. According to the two-tiered models, at the lower level the process of action-monitoring is equivalent to the production of an efference copy of a motor command for comparison against the reafferent signals generated by the movement. If a mismatch is detected, error signals are sent to the motor system for correction, otherwise the system goes on to the next step. The mechanisms involved in this comparison process operate at subpersonal levels and the representations they operate upon (motor commands, predictions, reafferent signals) are normally non-conscious (i.e. we have no conscious access to their contents). The higher level of action-monitoring also involves a comparison, but this time the comparison is between the high-level intention of the agent (his conscious representation of his goal) and the perceptual representation (mostly visual) of the configuration of the environment. This comparison would allow the agent to make a conscious agency judgement and to experience the action as his responsibility. Based on this twofold distinction between levels of action-monitoring, I would like to make the following tentative proposal. First, presumably, one function of the efference-copying and comparator mechanisms involved at the lower levels of action-monitoring is to allow the nervous system to distinguish between the perceptual changes caused by environmental changes and those caused by the execution of motor commands. Although these mechanisms operate at subpersonal levels, in the sense that the representations they operate on are not consciously accessible, it may be that their operation contributes to the awareness an agent has that he is acting rather than being passively moved about, where this awareness may not include an awareness of what one is doing. Second, it may be that, in most cases, conscious agency judgements involve two ingredients: namely, the result of the comparison, made at the high level of action-monitoring, between the intended goal as represented in the intention and the state of the environment, together with an awareness that one is or has just been acting.

Sometimes, though, sole reliance on this information leads agents to over-attribute to themselves actions that pertain to another agent. As demonstrated in the Daprati et al. (1998) experiment, such over-attributions may arise in

contexts where correct agency judgements require the agent to know not only *that* he acted and *what* he did (what goal was achieved), but also *how* he performed his action. It is known from the literature (Bridgeman, Kirch and Sperling, 1981; Goodale, Pélisson and Prablanc, 1986; Jakobson and Goodale, 1989; Fourneret and Jeannerod, 1998) that normal subjects are poorly aware of the determinants of their own actions and that, when required to make an agency judgement, they tend to privilege movement-related visual information over kinaesthetic information.[12] In Daprati et al.'s (1998) experiment, subjects—both normal controls and schizophrenic patients—were asked to judge whether what they saw on a TV screen while performing a simple hand movement was their own hand or an alien hand, where they were randomly shown either their own gloved hand, or the experimenter's similarly gloved hand performing the same or a different movement. In the 'easy' conditions, where they saw either their own hand or the experimenter's hand performing a different movement, the subjects made correct agency judgements. Yet, in the difficult 'experimenter-same' trials, the normal subjects misjudged the experimenter's hand as theirs in about 30% of cases, while the error-rate reached 77% in the group of schizophrenics with hallucinations, and 50% in the non-hallucinating schizophrenics. A possible explanation for this pattern of results is that, in the difficult condition, no obvious mismatch was likely to occur between the anticipated and the perceived final hand movement. What the subjects had to do in order to make the correct judgement was pay attention to slight differences in timing and kinematic pattern between their internal motor representations and that perceived by perceptual and kinaesthetic channels. Since these fine-grained temporal and kinematic aspects of the actions are presumably not encoded in the content of high-level intentions, what is needed to succeed at the task is, I suggest, that the subjects monitor their actions at a level intermediate between lower-level and high-level action-monitoring. In other words, they must have access to the contents of at least the higher levels of motor representations. At this intermediate level of monitoring, the comparison operates not between the high-level intention and the resulting action, but between certain aspects of a motor representation and the resulting action. It may be further suggested that what is impaired in schizophrenic patients is intermediate action-monitoring, that is a capacity to appropriately shift the attentional focus to internal motor representations.

To sum up, my tentative solution to the problem of explaining how it is possible for an organism to have a conscious grasp of its intentions in action and of their role in bringing about actions is based on the idea that the normally unconscious motor representations can get converted into conscious motor representations when execution is blocked or delayed. The motor image provides the organism with an awareness of what is intended and with a conscious

[12] See Jeannerod, 1999, for a review and a discussion of these data.

grasp of his body as a generator of acting forces. Moreover, the existence of a temporal gap between intention and action makes it possible to separate out cause and effect and allows for a notion of the agent as responsible for the continuity between intention and action to be constructed. Two points should bear emphasis. First, although blocking or delay are not the only ways in which attention can be drawn to motor representations—in certain circumstances, normal human beings appear able to voluntarily bring to consciousness at least part of the content of their motor representations—they should be granted some form of priority, insofar as they may be what makes us aware of the existence of motor representations in the first place. Second, I distinguished above three degrees in the experience of agency according to the types of action-monitoring involved, namely: an awareness *that* one is acting, an awareness of *what* one is doing (what one's goal is), an awareness of *how* one is acting. Although a conscious access to the content of one's motor representations is not required for the first two forms of awareness to arise, it is crucial to the third form of awareness. This third form of awareness is, in turn, a condition of possibility of prior intentions, hence of the move from stimulus-driven to deliberate actions.

8. Anchoring Action Concepts

Let us now turn to our last problem; that is, explaining how the mastery of action concepts is related to the non-conceptual content of intentions in action. Recall that I claimed that prior intentions have conceptual content whereas intentions in action have non-conceptual content. In order to account for the connection between prior intentions and intentions in action, it is necessary to explain how a subject can possess action concepts and how, when a prior intention causes an intention in action, the conceptual content of the prior intention can be converted into the non-conceptual content of an intention in action. One strategy to account for the possession of a set of concepts is to claim that possession of this set depends asymmetrically on the possession of a set of more basic concepts. However, as remarked by Peacocke (1992), since our repertoire of primitive, unstructured concepts is finite, this strategy has its limits. There will be at least one set of concepts that does not stand in the asymmetrical relation of dependence to any other set. Peacocke claims that relatively observational concepts that have peculiarly close links with perception are very plausible candidate elements for one such set. Similarly, I contend that, given the close connection between prior intentions and intentions in action, there must be a conceptually basic set of action concepts.

Peacocke (1992) distinguishes between two layers of non-conceptual representational content that a perceptual experience has: scenario content and protopropositional content. His notion of protopropositional content is of special interest given our purposes. It serves as a basis for the anchoring of relatively observational perceptual shape concepts such as *square*, *cubic*, *diamond-*

shaped or *cylindrical*, that can be possessed without the subject's awareness of any geometrical definition. As described by Peacocke, a protopropositional content contains an individual or individuals together with a property or relation (rather than concepts thereof) and represents the property or relation as holding of the individual or individuals. To put it in a different way, protopropositional content constitutes a layer of perceptual content where certain properties or relations of a visual scene are made salient. To borrow one of Peacocke's examples, for something to be perceived as square, the symmetry about the bisectors of its sides must be perceived, whereas for the same thing to be perceived as diamond-shaped, the symmetry about a line that bisects the object's corners must be perceived. The difference between perceiving something as a square and perceiving it as a regular diamond is a difference between the protopropositional contents of the two perceptions. Thus a condition for a thinker to possess the concept square is that she be able to have perceptual experiences with a certain type of protopropositional content (concerning the straightness of certain lines, the symmetry of the figure about the bisectors of those lines, the identity of certain lengths, etc.) and that she be disposed to form the belief that the demonstratively presented object is square when she has an experience with this kind of protopropositional content.

It would certainly be over-extending the analogy between perception and action to try to give an account of basic action concepts that would run exactly parallel to Peacocke's account of observational concepts. In his account, Peacocke stresses the reason-giving relation between the having of a perceptual experience with a particular non-conceptual content and a judgement that a given concept applies. As the Daprati et al. (1998) experiment discussed earlier illustrates, reason-given relations between motor representations and agency judgement can also occur. Yet there is another dimension of the grounding relation that is particularly relevant to action concepts. Our action concepts feature as constituents in our plans and our prior intentions. Insofar as these can be put to execution—that is cause intentions in action which in turn will cause actions—, it is necessary that the conceptual contents of our plans and prior intentions be convertible into the non-conceptual content of our intentions in action. For this conversion to be possible, it must be the case that action concepts get anchored, directly or indirectly, in non-conceptual content. Basic action concepts are those that have particularly close links to motor representations. Hence an important condition for an agent to possess a basic action concept is that he be able to form prior intentions involving this concept and to carry out these intentions by converting the conceptual content of the prior intention into a motor representation with a particular non-conceptual content. In other words, an account of the possession of basic action concepts also involves causal and reason-giving relations that run from prior intentions featuring action concepts to motor representations and, ultimately, actions.

Despite this difference in emphasis,[13] an important point in Peacocke's account that is certainly also relevant for an account of basic action concepts is that we could not be said to have mastery of certain concepts unless we were able to have experiences the non-conceptual representational content of which made salient certain properties or relations of what is experienced. According to the view of basic action concepts I have defended elsewhere (Pacherie, 1998), basic action concepts are demonstrative concepts. To have the concept of a basic action is to have a concept of acting 'thus', where 'thus' denotes a property made accessible to the agent by the motor representations he is able to form. Insofar as the demonstrative is used to pick out the properties characteristic of a given type of action and not simply to refer to a particular token of an action, the demonstrative 'thus' cannot refer to the content of the motor representation taken in all its fine-grained detail. On the contrary it is used to select certain aspects of this content, aspects that are shared by this and that action and that account for the fact that they fall under the same type. What this means is that in order to ground basic action concepts, we need to identify a level of non-conceptual content where properties and relations that are essential for the individuation of a type of action are made salient. Here again, I think that motor images are good candidates for such a level of content. Recall that, according to Jeannerod, motor preparation involves a hierarchy of motor representations, with the parameters of the action that are coded for at the higher levels acting as constraints on the lower levels of motor representation, and that the content of motor images corresponds to the content of the higher-level motor representations. To put it in another way, the higher levels of motor representations encode, and thus make salient, the goal of the action as well as some relatively global movement parameters, whereas lower-level motor representations work out the details, so to speak. Thus, if the conscious motor image gives us access to the content of higher-level motor representations, it indeed provides us with a representation of an action where its essential features are highlighted.

Insofar as our knowledge of the nature and particulars of motor representations and motor imagery is much less advanced than our knowledge of their perceptual counterparts, this account remains rather speculative. But, if true, it has important consequences for the individuation of basic action concepts, namely that mastery of such concepts requires that they be anchored in the content of motor images, and that a subject should not be granted possession of such concepts unless he has motor images. This does not mean that having motor images is sufficient for having motor concepts, just as it is not sufficient that a creature enjoys perceptual experiences with protopropositional content

[13] Note that this is indeed only a difference in emphasis. In his account of observational concepts, Peacocke, 1993, p. 89, allows that the direction of constitutive explanation runs not only from experience to concept possession but also from concept possession to experience.

for it to possess perceptual concepts. It is quite possible to conceive of creatures that enjoy experiences with structured non-conceptual content of the type described by Peacocke and yet lack the cognitive resources needed to construct concepts from that basis. Rather, the idea is that even a creature endowed with the cognitive resources needed to construct concepts would fail to construct certain concepts if, for some reason or other, it did not have experiences with a certain type of structured non-conceptual content.

There is a serious flaw in the tentative account of the development of action concepts that I just sketched. I have neglected an important constraint that all concepts must fulfil, namely what Evans (1982) called the Generality Constraint. The Generality Constraint states that for a thinker to be said to possess a concept *F*, it must be possible for him or her to entertain the thoughts *Fa*, *Fb*, *Fc*, etc. where *a*, *b*, *c* belong to a range of individuals of which the concept can significantly be said to be true or false. It follows from this principle that a subject could not be said to possess the concept of an action *A*, if he were not capable of entertaining the thought *Aa*, with *a* denoting an individual other than himself. As a consequence, if, as I suggested earlier, motor images are to provide the level of non-conceptual content needed for the anchoring of basic action concepts, it is indeed essential that we be able to form motor images not only of our own actions, but also of the actions of other individuals. But until now the only motor images I mentioned were motor images of our own actions. Can we make sense of the notion of motor images of the actions of other individuals? Here, we can avail ourselves of Jeannerod's fourth claim, that similar motor representations underlie the preparation and simulation of our own actions and the observation of actions by others. This claim is based on neurophysiological evidence first obtained by Rizzolatti and his group (Rizzolatti et al., 1988; Di Pellegrino et al., 1992) in their work on macaque monkeys and corroborated by a recent series of PET experiments on human subjects. In this last series of studies, conditions where subjects were intending actions, preparing for execution, mentally simulating actions and observing actions performed by other people were compared (Decety et al., 1994, 1997; Grafton et al., 1996, Rizzolatti et al., 1996, Stephan et al., 1995). The outcome of these studies is twofold: first, there exists a cortical network common to all conditions, to which the inferior parietal lobule, the ventral premotor area and part of the SMA contribute; second, motor representations for each individual condition are clearly specified by the activation of cortical zones that do not overlap between conditions.

If indeed conscious access to the content of our motor representations provides the basis for an apprehension of ourselves as agents and owners of representations and if the observation of an action performed by someone else activates a motor representation similar to the one activated during motor preparation for the same action, then similar processes would underlie apprehension of oneself and of others as agents. According to this claim, when a subject sees someone else acting, she generates a motor representation similar

to the one she *would* generate *if* she were preparing for that action. Since the motor representation is not followed by actual execution on her part, it is likely to get converted into a conscious motor image, hence the observer is aware of an intention in action. The difference with the case where the subject's own action is blocked or delayed, however, is that, although there is also a gap between the intention in action as experienced by the observer and the action, it is of a different kind. Although the observer does not perform the action herself, the action is actually performed. In such a case, the subject cannot consider herself as responsible for the continuity between the experienced intention in action and the action. In order to solve the dissonance she experiences, the observer must consider the person or animal observed as responsible for the continuity between the intention and the action, and in order to do so the observer must ascribe to the person or animal the intention in action that she experiences.

One last word of caution. Just as I was careful to insist that conscious access to the content of our motor representations is a necessary but not a sufficient condition for the possession of a concept of oneself as an agent and for the possession of action concepts, I should insist here that the fact that a motor representation is activated and that a motor image may be formed during the observation of others acting is not a sufficient condition for the possession of concepts of others as agents or for the possession of action concepts. In both cases, further cognitive resources are required and, maybe, as Russell (1996) suggests, the development of linguistic competence is needed for concepts of self, others, and action kinds to crystallize. What I claim is that motor images of our own actions and of actions performed by others provide a basis for the development and application of such concepts.

9. Conclusion

I have argued that although Searle's distinction between prior intentions and intentions in action constituted a progress over earlier versions of the causal theory of action, it also raised important new issues. In this paper, I have tried to address some but by no means all of them.[14] Once a distinction is posited between two types of intentions, one must specify what the nature of their respective contents is supposed to be and explain how the two types of intentions are connected. I have suggested that in addressing those issues we could

[14] For instance, although I have tried to confront the issue of the self-referentiality of intentions in action, I have said nothing about the purported self-referentiality of prior intentions. Similarly, beyond suggesting that basic action concepts had to be grounded in a level of non-conceptual content, I said very little about the general structure of action concepts. Last but not least, although, arguably, there wouldn't be much point in trying to give a precise characterization of the content of intentions unless this content was causally efficacious in the production of behaviour, I have not attempted to address this momentous issue here.

benefit from the insights provided by recent work in the cognitive neuroscience of action. In particular, I have tentatively suggested that neurophysiological work on motor intention could help us give a more precise characterization of the content of intentions in action and that motor imagery could play a crucial role in bridging the gap between prior intentions and intentions in action.

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